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Purpose of study was to test hypothesis that when individual differences in scholastic aptitude and prior academic achievement have been removed, there is no difference between senior and freshman College of Agriculture students in their mathematical knowledge as measured by Cornell Mathematics Test (1951 edition). Evidence was found that seniors surpassed freshmen in knowledge of common mathematical principles.

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IV-5 (Sciences)

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Mathematical Knowledge of Senior and Freshman College of Agriculture Students at Cornell University

by J. Stanley Ahmann, Cornell University
Thomas G. Bentson, Cornell University, 1952

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It was the purpose of this investigation to test the following hypothesis: When individual differences in scholastic aptitude and prior academic achievement have been removed, there is no difference between senior and freshman College of Agriculture students in their mathematical knowledge as measured by the Cornell Mathematics Test, 1951 Edition. The mathematics test was designed to measure a student's knowledge of common mathematical principles usually taught in courses prior to elementary calculus.

The Cornell Mathematics Test was administered to the College of Agriculture beginning freshmen in the fall of 1951 and to a group of College of Agriculture seniors who voluntarily cooperated. Because it was reasonable to assume that the senior students would be a more select class than the freshman students, and that this selective factor would favor the seniors in terms of the criterion, individual differences in scholastic aptitude as measured by the Ohio State University Psychological Test and individual differences in prior academic achievement as measured by the Cooperative General Science Test were removed. Limitations admittedly existed in the assumption that the Cooperative General Science Test was a reasonable measure of prior academic achievement. The test was used in this capacity, however, because no better instrument was available.

In order to test the previously mentioned hypothesis, certain basic assumptions were made.

1. Differences in mathematical training in the secondary schools introduced no bias in this study.

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2. The Cornell Mathematics Test (1951 Edition) was a valid measure of College of Agriculture students' knowledge of common mathematical principles.

3. The seniors who voluntarily completed the Cornell Mathematics Test were an adequate sample of College of Agriculture seniors.

4. Differences in chronological ages introduced no bias in this study.

The mean scores for the criterion and the two control variables are shown in Table 1.

Table 1

Mean Scores of All Variables for Senior and Freshman Students

Class Level	Number of Students	Cornell Mathematics	OSU Test	Coop Science Test
Senior	69	41.70	75.23	55.38
Freshman	106	36.31	76.07	57.75
Total	175	38.43	75.77	56.81

It was surprising to note that the freshmen have surpassed the seniors to a minor degree in scholastic aptitude and science test scores. The assumption that the senior students would be a more select group was obviously untrue. However, this reversal did not lessen the need for controlling individual differences in scholastic aptitude and prior academic achievement since any unbalancing influences of these types, irrespective of direction, will contribute a bias.

The differences between the criterion means is sizable. To determine

whether this difference, when adjusted for individual differences in scholastic aptitude and prior academic achievement, could be the result of a sampling accident, an analysis of covariance was computed. The results are summarized in Table 2.

Table 2

Analysis of Covariance of Cornell Mathematics Test Scores

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Squares
Total	172	9694.2242	
Within Subgroups	171	8181.0559	47.8424
Difference	1	1513.1683	1513.1683

$$F_{1,171} = \frac{1513.1683}{47.8424} = 31.63$$

The F-value of 31.63 with 1 and 171 degrees of freedom is significant. Therefore, when the criterion means of the two subgroups were adjusted for individual differences in scholastic aptitude and prior academic achievement, the difference between the Cornell Mathematics Test mean score for seniors and the mean score for freshmen was so large that it undoubtedly was not caused by a sampling accident. Presumably the difference can be attributed to the fact that one group had practically completed a four year college course whereas the other is just beginning.

The mathematics test adjusted mean score for seniors was 42.10, whereas the adjusted mean score for freshmen was 36.05. Therefore, it can be concluded that in so far as scholastic aptitude is controlled by the Ohio State University Psychological Examination, prior academic achievement is controlled by Cooperative General Science Test scores, and no other pertinent factors

related to knowledge of common mathematical principles contributed a bias, evidence has been found that College of Agriculture seniors surpass College of Agriculture freshmen in knowledge of common mathematical principles as measured by the Cornell Mathematics Test.

There seems little doubt that the hypothesis here tested could have been more efficiently tested by means of a longitudinal study in which freshmen would be pretested in mathematics as they entered the College of Agriculture, and then retested four years later as graduating seniors. Also, stratification of the sample on the basis of major area of study would seem advisable. The mathematical requirements of the various curricula differ sufficiently to require separate studies of allied curricula for an adequate investigation of the problem.

It is obvious that the foregoing analysis has made no attempt to study the problem of whether the presence or absence of mathematical deficiencies influenced the tendency of potentially successful students to leave college prior to graduation. Information concerning the relationship between knowledge of common mathematical principles and tendency to leave college prior to graduation certainly would enhance the faculty's grasp of the importance of mathematics to the student in the College of Agriculture.